Title: Independent and combined association of physical fitness and subjective well-being with fibromyalgia severity: the al-Ándalus project

Authors: Fernando Estévez-López, MSc [a,b,*], Cindy M. Gray, PhD [b], Víctor Segura Jiménez, MSc [a], Alberto Soriano-Maldonado, MSc [a], Inmaculada C. Álvarez-Gallardo, MSc [a], Manuel J. Arrayás-Grajera, MSc [c], Ana Carbonell-Baeza, PhD [d], Virginia A. Aparicio, PhD [a,e], Manuel Delgado-Fernández, PhD [a], Manuel Pulido-Martos, PhD [f]

Affiliations: [a] Department of Physical Education and Sport, Faculty of Sport Sciences, University of Granada, Granada, Spain; [2]Institute of Health and Wellbeing, University of Glasgow, Glasgow, UK; [c] Department of Physical Education, Music, and Fine Arts, Faculty of Education, University of Huelva, Huelva, Spain; [d] Department of Physical Education, Faculty of Sciences Education, University of Cádiz, Cádiz, Spain; [e] Department of Physiology, Faculty of Pharmacy, University of Granada, Granada, Spain; [f] Department of Psychology, School of Humanities and Sciences of Education, University of Jaén, Jaén, Spain.

*** Corresponding author:** Fernando Estévez-López, Department of Physical Education and Sport, Faculty of Sport Sciences, University of Granada, Carretera de Alfacar, s/n, 18011 Granada, Spain. Phone: +34 958 244 375 Fax: +34 958 244 369 E-mail: festevez@ugr.es

Title: Independent and combined association of physical fitness and subjective well-being with fibromyalgia severity: the al-Ándalus project

ABSTRACT

Purpose: The present study aimed: 1) to test the associations of overall physical fitness and subjective well-being with fibromyalgia severity; and 2) to determine whether the combination of overall physical fitness and subjective well-being is associated with fibromyalgia severity among adult women patients.

Methods: This cross-sectional study included 424 participants from Andalusia, Southern Spain. Overall physical fitness and the components of subjective well-being, positive affect, negative affect and cognitive well-being, and fibromyalgia severity were assessed by means of the Functional Senior Physical Fitness Test Battery, the Positive And Negative Affect Schedule, the Satisfaction With Life Scale, and the Fibromyalgia Impact Questionnaire, respectively.

Results: Overall physical fitness (^{2} =-.23), positive affect (^{2} =-.18), negative affect (^{2} =.26), and cognitive well-being (^{2} =-.18) were all associated with fibromyalgia severity. The patients with the highest overall physical fitness and the best subjective well-being showed ~15% lower fibromyalgia severity than the groups with the lowest fitness and poorest subjective well-being (Cohen's d > 1.0).

Conclusion: Our results suggest that higher levels of overall physical fitness and subjective well-being are associated with lower fibromyalgia severity. Moreover, there was a combination of physical fitness and subjective well-being so that the patients with higher physical fitness and better subjective well-being (high positive affect, low negative affect, or high cognitive well-being) presented lower fibromyalgia severity than the group with poorer levels.

Keywords: Chronic pain; Functional capacity; Physical fitness; Psychology; Quality of life; Resilience (psychological).

INTRODUCTION

Fibromyalgia is a common health condition of unknown etiology characterized by a history of chronic widespread musculoskeletal pain and tenderness which persists for at least three months [1]. In fibromyalgia, pain amplification might be generated through both central and peripheral mechanisms. For instance, central aberrations of the endocrine system and brain have been observed in fibromyalgia [2], but also metabolic abnormalities in the muscles have been reported [3]. New approaches have pointed out that a disturbed thermoregulation may lead to central sensitization among fibromyalgia patients [4]. In addition to pain and tenderness, people with fibromyalgia often report cognitive difficulties, fatigue, musculoskeletal stiffness, and poor sleep quality [5]. A number of studies have shown that poor physical fitness [6-10] and decreased subjective well-being [11] are associated with fibromyalgia severity.

When people experience chronic pain, they often avoid physical effort so as not to exacerbate their symptoms [12], leading to decreased physical fitness [13]. Physical activity is recommended to help patients cope with fibromyalgia [14] and active pain management is associated with better adjustment to the condition [15]. Although there are some controversies [16], most of previous studies have demonstrated associations between the individual components of physical fitness and fibromyalgia severity [6-10]. It is remarkable that physical activity recommendations for people with fibromyalgia focus on increasing physical fitness holistically [17], and thus it is important to improve understanding of the associations of overall physical fitness and fibromyalgia severity.

Although treatments for fibromyalgia that include physical activity have been shown to have beneficial short [18] and long term effects [19], patient outcomes remain

highly variable [20]. De Ridder, Geenen, Kuijer, and Van Middendorp [21] have indicated that a number of psychological variables are involved in the adaptation to chronic pain (e.g., subjective well-being). Thus, psychological techniques are commonly used in interventions for people with fibromyalgia. Sturgeon and Zautra [22] suggest that psychological vulnerability and resilience are involved in the adaptation to chronic pain. Whilst traditional research has mainly focused on psychological vulnerability (e.g., anxiety, depression or pain catastrophizing), a growing body of evidence suggests that resilience to chronic pain may have important health benefits for people with fibromyalgia [22]. Resilience is a construct that describes the psychological factors, including subjective well-being, that allow people to maintain positive functioning in the face of significant physical or psychological challenges [23]. Subjective well-being plays an adaptive role in helping people cope with adverse situations. It is widely recognised that people with high levels of subjective well-being (both patient and non-patient groups) have better perceptions of their global health [24; 25].

Improved understanding of the physical and psychological factors that moderate fibromyalgia severity is important to help clinicians to develop more effective and individualized treatments for people with fibromyalgia. The main aims of the present study were therefore: 1) to test the associations of overall physical fitness and subjective well-being with fibromyalgia severity; and 2) to determine whether the combination of overall physical fitness and subjective well-being is associated with fibromyalgia severity among adult women patients.

MATERIAL AND METHODS

Participants

The sample procedure to recruit a representative sample of women with fibromyalgia from Southern Spain is described elsewhere [26]. All interested participants (*n*=616) gave written informed consent before taking part in the study. In the current cross-sectional study assessments were carried out between November, 2011 and January, 2013. Inclusion criteria for the current study were: (i) to be an adult woman (aged from 18 to 65 years old), i.e., men and older adult women were excluded; (ii) a medical diagnosis of fibromyalgia by a rheumatologist (participants were requested to provide their medical records to confirm their diagnosis); (ii) meeting the 1990 American College of Rheumatology (ACR) fibromyalgia criteria [1]; (iii) absence of acute or terminal illness (such as cancer, stroke, recent cardiopathy, severe coronary disease, schizophrenia or any other disabling injury). People with severe cognitive impairment, as defined by a score of less than 10 on the Mini Mental State Examination (MMSE) [27; 28], and participants who did not completed all the physical assessments and questionnaires were excluded. Assessments were performed by researchers fully trained to standard measurement and assessment protocols to reduce inter-examiner error. The project was reviewed and approved by the Ethics Committee of the *Hospital Virgen de las Nieves* (Granada, Spain). The ethical guidelines of the Declaration of Helsinki (modified in 2000) were followed.

Measures

Cognitive impairment was assessed using the MMSE [27; 28] which is a structured scale that consists of 30 items grouped into seven categories: orientation to place,

orientation to time, registration, attention and concentration, recall, language, and visual construction. The MMSE scores ranging from 0 to 30, and lower scores reflect greater cognitive impairment.

Anthropometric measurements were assessed using a portable eight-polar tactile-electrode impedanciometer (InBody R20; Biospace, Gateshead, UK) to measure weight (kg). Height (cm) was measured using a stadiometer (Seca 22, Hamburg, Germany). Body mass index was calculated as weight (in kg) divided by height (in m) squared.

Physical fitness was assessed using the Functional Senior Physical Fitness Test Battery [29] which is feasible and reliable among women with fibromyalgia [30]. Additionally, we also measured the handgrip strength, which is commonly used in fibromyalgia patients [6; 7]. Detailed descriptions of the procedures followed are available elsewhere [30]. Briefly, lower body muscular strength was assessed using the '*30-second chair stand test'*. Upper body muscular strength was assessed using the '*arm curl test'* and the '*handgrip strength test'*. Lower and upper body flexibility was measured using the '*chair sit and reach test*' and the '*back scratch test'*, respectively. Motor agility/dynamic balance was measured using the '*8-feet up and go test'* (where higher scores represent poorer performance), and cardio-respiratory fitness was assessed with the '*6-minute walk test'*.

Subjective well-being was assessed using the Spanish versions of the Positive and Negative Affect Schedule (PANAS) [31] and the Satisfaction With Life Scale (SWLS) [32]. The PANAS assesses affective well-being using two subscales (positive and negative affect) with scores ranging from 10 to 50, and higher scores reflect greater positive or negative affect. SWLS scores range from 5 to 25, and higher scores

reflect greater cognitive well-being. Participants were asked to use an 'in general' time-frame for both instruments. Both questionnaires, the PANAS and the SWLS, are commonly used in fibromyalgia [33-36].

Fibromyalgia severity was assessed using the Spanish version of the Fibromyalgia Impact Questionnaire (FIQ) [37]. FIQ scores range from 0 to 100, and higher scores indicate greater severity. The FIQ uses a 'last 7 days' time frame.

Procedure

Assessments took place over three consecutive days. On day 1, a tender points examination was conducted, body composition measurements were taken, and socio-demographic data were collected. On day 2, the PANAS, SWLS, and FIQ questionnaires were completed by participants at home without supervision. On day 3, physical fitness was assessed.

Statistical analyses

To examine the associations of overall physical fitness with fibromyalgia severity, four normalized z-scores ([value-mean]/standard deviation [SD]) were computed: 1) a 'cardio-respiratory fitness z-score' using data from the '*6-minute walk test'*; 2) a 'flexibility z-score' using the mean of the z-scores of the '*chair sit and reach test'* and the '*back scratch test'*; 3) a 'motor agility/dynamic balance z-score' using reversed '*8 feet up and go test'* scores so that higher scores represented better performance; 4) a 'muscular strength z-score' using the mean of the z-scores of the '*30-second chair stand test'*, '*arm curl test*' and '*handgrip strength test'*. Finally, the overall physical fitness score was calculated as the mean of the four physical fitness z-scores. Prior to the main analyses, Pearson's correlations were used to check whether age, marital

status, educational level, work status, years since the first symptoms until clinical diagnosis, years since clinical diagnosis, body mass index status, alcohol consumption frequency, and smoking status were associated with fibromyalgia severity in order to test their role as potential confounders (all $p > .25$; except for work status, alcohol consumption frequency, and smoking status –all $p < .05$).

Pearson's correlations were used to examine associations between overall physical fitness, positive affect, negative affect, and cognitive well-being with fibromyalgia severity. Sequential multiple regressions were performed with independent variables entered stepwise: Step 1, overall physical fitness; Step 2, positive affect and negative affect; Step 3, cognitive well-being. The order was determined by the researcher. Overall physical fitness was considered to be important since past research has usually shown that physical fitness is associated with fibromyalgia severity. The association of affective well-being and fibromyalgia severity has been less explored. Given that there is a lack of knowledge of the association of cognitive well-being and fibromyalgia severity, it was incorporated to the model in the last step.

The overall physical fitness, positive affect, negative affect and cognitive well-being scores were dichotomised using the means as the cut-off value –i.e., low levels were those below the mean and high levels were those equal or above the mean. Thereafter, we determined whether the combination of overall physical fitness and individual subjective well-being components is associated with fibromyalgia severity among women patients. Three new variables with four categories were computed: for example, for positive affect, the categories were: 'high overall physical fitness' + 'high positive affect'=1; 'low overall physical fitness' + 'high positive affect'=2; 'high overall physical fitness' + 'low positive affect'=3; and 'low overall physical

fitness' + 'low positive affect'=4. A one-way analysis of variance (ANOVA) was used to examine differences in fibromyalgia severity (FIQ z-scores) between the groups; Bonferroni corrections were used for multiple comparisons. Additionally, we calculated the effect sizes using the Cohen's *d* (standardised mean differences) statistic. Values of Cohen's *d* ~0.2, ~0.5 and ~0.8 were considered to represent small, medium and large effects, respectively.

The analyses were performed with Statistical Package for Social Sciences (IBM SPSS Statistics for Mac, version 20.0; Armonk, NY) and the level of significance was set at $p < .05$ (two-tailed).

RESULTS

Men (n=21) and older adult women (>65; n=25) were not included in the present study. Thirty-nine fibromyalgia patients were not previously diagnosed and 101 fibromyalgia participants did not meet the 1990 ACR criteria. Two participants were excluded because they had acute or severe illness. Additionally, 35 participants were excluded because they did not complete all the assessments (17 participants did not filled all the questionnaires and 18 participants did not perform the physical fitness tests due to physical injury). The final study sample comprised 424 adult women with fibromyalgia from Southern Spain (Andalusia). A 59% (*n*=249) of them were severely affected –i.e., a FIQ total score >70. Table 1 shows the characteristics of the study participant.

Associations of overall physical fitness and subjective well-being with fibromyalgia severity

The correlations of overall physical fitness, positive affect, negative affect, and cognitive well-being with fibromyalgia severity were moderate ($r(422) = -0.39$, $p < .001$, $r(422) = -0.43$, $p < .001$, $r(422) = 0.45$, $p < .001$, and $r(422) = -0.43$, $p < .001$; respectively). Sequential regression model revealed that high overall physical fitness ($t = 5.44$; $p < .001$), high positive affect ($t = 3.90$; $p < .001$), low negative affect ($t = 5.80$; $p < .001$) and high cognitive well-being ($t = 3.82$; $p < .001$) were independently and inversely associated with fibromyalgia severity (Table 2). The final model explained 35% of the variability in fibromyalgia severity (adjusted $R^2 = 0.35$; $F(4, 419) = 57.91$; $p < .001$). In order to test the role of the potential confounders the regression analysis was repeated including work status, alcohol consumption frequency, and smoke status in the first step, and the results did not change.

Associations of the combination of overall physical fitness and subjective well-being components with fibromyalgia severity

The ANOVA revealed that the combination of overall physical fitness and the individual components of subjective well-being was associated with fibromyalgia severity (positive affect: $F(3, 420) = 25.22$, $p < .001$; negative affect: $F(3, 420) = 28.25$, $p < .001$; cognitive well-being $F(3, 420) = 28.94$, $p < .001$; respectively). The differences between fibromyalgia severity in the high overall physical fitness + high positive affect group vs. the low overall physical fitness + low positive affect group, the high overall physical fitness + low negative affect group vs. the low overall physical fitness + high negative affect group, and the high overall physical fitness + high cognitive well-being group vs. the low overall physical fitness + low cognitive well-being group were ~15%, and all effect sizes were large (Cohen's $d > 1.0$). Further information is available in Table 3 (appendix 1). Figure 1 shows the main profiles of patients with fibromyalgia, with one high (left bar, z-score ~-0.5), two high to severe (central bars, z-score close to the mean), and one severe (right bar, z-score ~0.5) fibromyalgia severity groups.

DISCUSSSION

The findings of the present study extend current knowledge on the association of physical fitness and subjective well-being with the overall impact of the disease in adult women with fibromyalgia. Overall physical fitness, positive affect, and cognitive well-being were inversely associated with fibromyalgia severity, while negative affect was directly associated with fibromyalgia severity. In addition, the combination of overall physical fitness and individual components of subjective well-being showed significant associations with fibromyalgia severity: people with high overall physical fitness and either high positive affect, low negative affect or high cognitive well-being experience lower fibromyalgia severity compared to those with low physical fitness and either low positive affect, high negative affect or low cognitive well-being.

Overall physical fitness is associated with fibromyalgia severity

Our results provide new evidence that overall physical fitness is inversely associated with fibromyalgia severity. Past research focused on single physical fitness components (e.g., muscular strength) or performance tests (e.g., handgrip strength test or 30-second chair stand test) [6-10]. Our findings provide support for current recommendations for the management of fibromyalgia that advocate the development of interventions that aim to improve physical fitness holistically [17], rather than those with a focus on separate individual components of physical fitness. Future intervention studies will determine whether a causal relationship exists so that enhancing physical fitness reduces fibromyalgia severity in this population.

Subjective well-being is associated with fibromyalgia severity

Our study also provides new evidence on the associations between subjective well-being and fibromyalgia severity. It is well-known that positive affect is a source of resilience against pain among people with fibromyalgia [38]. Previous studies have not reported any associations between positive affect and fibromyalgia severity [11]. The current study contrasts previous findings by demonstrating that positive affect is not only associated to lower pain intensity (previously reported by others [38]) but also to lower fibromyalgia severity. Our results have also demonstrated than increased cognitive well-being may potentially help people with fibromyalgia better manage their symptomatology, which requires future prospective research.

The finding that increased negative affect was associated with greater self-reported fibromyalgia severity is consistent with previous research. A prior study [11] used affect balance style (a combination of negative affect and positive affect scores) to distinguish four groups of patients with fibromyalgia and other medical conditions: healthy (low negative affect and high positive affect), low (low values in both scores), reactive (high values in both scores), and depressive (high negative affect and low positive affect). They demonstrated that the affect balance styles characterized by higher negative affect (i.e., reactive and depressive) were associated with increased fibromyalgia severity in the whole study sample (i.e. people with fibromyalgia and people with other medical conditions).

Combined impact of overall physical fitness and components of subjective well-being on fibromyalgia severity

Recently, Sturgeon and Zautra [22] have indicated that more sophisticated psychological models are required to explain the complex process of adaption to pain in chronic medical conditions. However, it is highly likely that adaptation to pain is

329 influenced by a complex interplay between psychological and physical factors. Our
330 findings support this hypothesis by showing that combinations of: high overall
331 physical fitness and better subjective well-being (e.g. high positive affect, low
332 negative affect, or high cognitive well-being) are associated with lower fibromyalgia
333 severity. These findings support the implementation of intervention studies using a
334 multidisciplinary approach for the management of fibromyalgia [39], aiming at
335 enhancing physical fitness holistically and improving subjective well-being in patients
336 with fibromyalgia.

337 The combination of overall physical fitness and components of subjective well-being
338 helped us to find three different groups of patients with different levels of
339 fibromyalgia severity (i.e., high, high to severe, and severe fibromyalgia severity).
340 Since fibromyalgia is a complex health condition, it is important to identify subgroups
341 of patients in order to design tailored therapies. A preliminary study [40] classified
342 patients regarding to levels of morning tiredness, anxiety and depression as
343 fibromyalgia-type I (i.e., high levels of these symptoms) and fibromyalgia-type II (i.e.,
344 low levels of these symptoms). These findings have been replicated by other authors
345 [41]. Wilson and colleagues [42] distinguished between four groups of patients
346 depending on levels of three types of symptoms; musculoskeletal, non-
347 musculoskeletal, and psychological symptoms. Hassett and colleagues [11] used
348 affect balance styles (i.e., the combination of positive affect and negative affect) to
349 describe fibromyalgia patient profiles. From our data emerged another possibility to
350 classify patients with fibromyalgia. The main difference between profiles reported in
351 past research and the identification made in the current study is that we used
352 performance-based tests and questionnaires to assess physical fitness (a measure of
353 physical functioning) and subjective well-being (an assessment of psychological

functioning), respectively. It could be speculated that the subgroups of patients found in the current study can help to develop tailored therapies that focus on overall physical fitness, subjective well-being or both of them.

Clinical applications

Since fibromyalgia is currently incurable, symptom management is the main treatment. Overall physical fitness can be targeted by exercise interventions while subjective well-being can be improved through cognitive-behavioural therapies. Additionally, the clinical picture of fibromyalgia and the effectiveness of therapies are highly variable among patients. The development of individually tailored interventions is a priority for both clinicians and psychologists [43; 44]. We could speculate that multidisciplinary interventions including both exercise programmes and psychological therapies, such as cognitive-behavioural therapy, could be particularly advisable for the group of patients with low physical fitness and low subjective well-being, and further research is warranted.

Limitations and Strengths of the Study

A number of limitations should be considered. First, the cross-sectional nature of this study does not allow inferences about causality. Second, since participation in the study relied on volunteers, better psychological and physical health might be expected among the study sample than among the general population of people with fibromyalgia. Third, several variables were assessed by self-reported instruments. However, although inadvertent (e.g., inaccurate recall) or intentional (e.g., influenced by social desirability) misreported answers are feasible, all of the instruments used in the present study have been shown to be reliable and valid. Fourth, affective well-

being was assessed at a single time point (providing a measure of its intensity), whereas repeated measurement over an extended period (i.e., affective well-being frequency) is recommended.

The main strength of the present study is the sample size, which was large compared with previous studies [6-10] and highly representative of the Andalusian (Southern Spain) population of women with fibromyalgia [26]. Additionally, physical fitness was assessed by a performance-based test battery which is feasible and reliable among women with fibromyalgia [30].

Conclusion

The findings of the present study suggest that higher levels of overall physical fitness and subjective well-being are associated with lower fibromyalgia severity. Moreover, there was a combination of physical fitness and subjective well-being so that the patients with higher physical fitness and better subjective well-being (high positive affect, low negative affect, or high cognitive well-being) presented ~15% lower fibromyalgia severity than the group with the poorest levels.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge all participants for their collaboration. We would like to thank collaborators in the al-Ándalus project, Prof. Sally Wyke (Institute of Health and Wellbeing, University of Glasgow) for helpful comments on preliminary versions of this manuscript, and Dr. Philip Mason (University of Glasgow) and Dr. Pedro Femia Marzo (University of Granada) for statistical advice. This study was funded by the Spanish Ministry of Science and Innovation [I+D+I DEP2010-15639], the Consejeria de Turismo, Comercio y Deporte (CTCD-201000019242-TRA), the Andalusia Institute of Sport, the Center of Initiatives and Cooperation to the Development (CICODE, University of Granada), and the Andalusian Federation of people with fibromyalgia, chronic fatigue, and multiple chemical sensitivity (Alba Andalucía). VSJ [AP2010-0963] and ASM [FPU12/00963] were supported by the grants from the Spanish Ministry of Education; and IAG was supported by the Spanish Ministry of Science and Innovation [BES-2011-047133].

CONFLICT OF INTEREST

The authors have no competing interests to report.

REFERENCES

1. Wolfe, F., Smythe, H. A., Yunus, M. B., Bennett, R. M., Bombardier, C., Goldenberg, D. L., Tugwell, P., Campbell, S. M., Abeles, M., & Clark, P. (1990). The American College of Rheumatology 1990 criteria for the classification of fibromyalgia. Arthritis and Rheumatism, 33(2), 160-172.
2. Geenen, R., & Bijlsma, J. W. (2010). Deviations in the endocrine system and brain of patients with fibromyalgia: cause or consequence of pain and associated features? Annals of the New York Academy of Sciences, 1193, 98-110.
3. Park, J. H., Niermann, K. J., & Olsen, N. (2000). Evidence for metabolic abnormalities in the muscles of patients with fibromyalgia. Curr Rheumatol Rep, 2(2), 131-140.
4. Albrecht, P. J., Hou, Q., Argoff, C. E., Storey, J. R., Wymer, J. P., & Rice, F. L. (2013). Excessive peptidergic sensory innervation of cutaneous arteriole-venule shunts (AVS) in the palmar glabrous skin of fibromyalgia patients: implications for widespread deep tissue pain and fatigue. Pain Medicine, 14(6), 895-915.
5. Wolfe, F., Clauw, D. J., Fitzcharles, M. A., Goldenberg, D. L., Katz, R. S., Mease, P., Russell, A. S., Russell, I. J., Winfield, J. B., & Yunus, M. B. (2010). The American College of Rheumatology preliminary diagnostic criteria for fibromyalgia and measurement of symptom severity. Arthritis Care Res (Hoboken), 62(5), 600-610.
6. Aparicio, V. A., Carbonell-Baeza, A., Ruiz, J. R., Aranda, P., Tercedor, P., Delgado-Fernandez, M., & Ortega, F. B. (2013). Fitness testing as a

discriminative tool for the diagnosis and monitoring of fibromyalgia. Scandinavian Journal of Medicine and Science in Sports, 23(4), 415-423.

7. Aparicio, V. A., Ortega, F. B., Heredia, J. M., Carbonell-Baeza, A., Sjostrom, M., & Delgado-Fernandez, M. (2011). Handgrip strength test as a complementary tool in the assessment of fibromyalgia severity in women. Archives of Physical Medicine and Rehabilitation, 92(1), 83-88.

8. Assumpcao, A., Sauer, J. F., Mango, P. C., & Pascual Marques, A. (2010). Physical function interfering with pain and symptoms in fibromyalgia patients. Clinical and Experimental Rheumatology, 28(6 Suppl 63), S57-63.

9. Carbonell-Baeza, A., Ruiz, J. R., Aparicio, V. A., Ortega, F. B., & Delgado-Fernández, M. (2013). The 6-Minute Walk Test in Female Fibromyalgia Patients: Relationship With Tenderness, Symptomatology, Quality of Life, and Coping Strategies. Pain Management Nursing, 14(4), 193-199.

10. Henriksen, M., Lund, H., Christensen, R., Jespersen, A., Dreyer, L., Bennett, R. M., Danneskiold-Samsoe, B., & Bliddal, H. (2009). Relationships between the fibromyalgia impact questionnaire, tender point count, and muscle strength in female patients with fibromyalgia: a cohort study. Arthritis and Rheumatism, 61(6), 732-739.

11. Hassett, A. L., Simonelli, L. E., Radvanski, D. C., Buyske, S., Savage, S. V., & Sigal, L. H. (2008). The relationship between affect balance style and clinical outcomes in fibromyalgia. Arthritis and Rheumatism, 59(6), 833-840.

12. Damsgard, E., Dewar, A., Roe, C., & Hamran, T. (2011). Staying active despite pain: pain beliefs and experiences with activity-related pain in patients with chronic musculoskeletal pain. Scandinavian Journal of Caring Sciences, 25(1), 108-116.

13. Elfving, B., Andersson, T., & Grooten, W. J. (2007). Low levels of physical activity in back pain patients are associated with high levels of fear-avoidance beliefs and pain catastrophizing. Physiotherapy Research International, 12(1), 14-24.

14. Kelley, G. A., Kelley, K. S., Hootman, J. M., & Jones, D. L. (2010). Exercise and global well-being in community-dwelling adults with fibromyalgia: a systematic review with meta-analysis. BMC Public Health, 10, 198.

15. Gauffin, J., Hankama, T., Hannonen, P., Kautiainen, H., Pohjolainen, T., & Haanpaa, M. (2013). Do fibromyalgia patients use active pain management strategies? A cohort study. Journal of Rehabilitation Medicine, 45(5), 477-480.

16. Ayan, C., Martin, V., Alonso-Cortes, B., Alvarez, M. J., Valencia, M., & Barrientos, M. J. (2007). Relationship between aerobic fitness and quality of life in female fibromyalgia patients. Clinical Rehabilitation, 21(12), 1109-1113.

17. Jones, K. D., Clark, S. R., & Bennett, R. M. (2002). Prescribing exercise for people with fibromyalgia. AACN Clinical Issues, 13(2), 277-293.

18. Hauser, W., Bernardy, K., Arnold, B., Offenbacher, M., & Schiltenwolf, M. (2009). Efficacy of multicomponent treatment in fibromyalgia syndrome: a meta-analysis of randomized controlled clinical trials. Arthritis and Rheumatism, 61(2), 216-224.

19. Kaleth, A. S., Saha, C. K., Jensen, M. P., Slaven, J. E., & Ang, D. C. (2013). Effect of moderate to vigorous physical activity on long-term clinical outcomes and pain severity in fibromyalgia. Arthritis Care Res (Hoboken), 65(8), 1211-1218.

20. Mease, P. J., Clauw, D. J., Arnold, L. M., Goldenberg, D. L., Witter, J., Williams, D. A., Simon, L. S., Strand, C. V., Bramson, C., Martin, S., Wright, T. M., Littman, B., Wernicke, J. F., Gendreau, R. M., & Crofford, L. J. (2005). Fibromyalgia syndrome. Journal of Rheumatology, 32(11), 2270-2277.

21. de Ridder, D., Geenen, R., Kuijer, R., & van Middendorp, H. (2008). Psychological adjustment to chronic disease. Lancet, 372(9634), 246-255.

22. Sturgeon, J. A., & Zautra, A. J. (2013). Psychological resilience, pain catastrophizing, and positive emotions: perspectives on comprehensive modeling of individual pain adaptation. Curr Pain Headache Rep, 17(3), 317.

23. Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: a critical evaluation and guidelines for future work. Child Development, 71(3), 543-562.

24. Lamers, S. M., Bolier, L., Westerhof, G. J., Smit, F., & Bohlmeijer, E. T. (2012). The impact of emotional well-being on long-term recovery and survival in physical illness: a meta-analysis. Journal of Behavioral Medicine, 35(5), 538-547.

25. Roysamb, E., Tambs, K., Reichborn-Kjennerud, T., Neale, M. C., & Harris, J. R. (2003). Happiness and health: environmental and genetic contributions to the relationship between subjective well-being, perceived health, and somatic illness. Journal of Personality and Social Psychology, 85(6), 1136-1146.

26. Segura-Jimenez, V., Alvarez-Gallardo, I. C., Carbonell-Baeza, A., Aparicio, V. A., Ortega, F. B., Casimiro, A. J., & Delgado-Fernandez, M. (2014). Fibromyalgia has a larger impact on physical health than on psychological health, yet both are markedly affected: The al-Andalus project. Seminars in Arthritis and Rheumatism.

27. Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research, 12(3), 189-198.

28. Lobo, A., Ezquerra, J., Gómez, B. F., Sala, J., & Seva, D. A. (1979). [Cognocitive mini-test (a simple practical test to detect intellectual changes in medical patients)]. Actas Luso-Españolas de Neurología, Psiquiatría y Ciencias Afines, 7(3), 189.

29. Rikli, R. E., & Jones, C. J. (1999). Development and validation of a functional fitness test for community-residing older adults. Journal of aging and physical activity, 7, 129-161.

30. Carbonell-Baeza, A., Alvarez-Gallardo, I. C., Segura-Jimenez, V., Castro-Pinero, J., Ruiz, J. R., Delgado-Fernandez, M., & Aparicio, V. A. (2014). Reliability and Feasibility of Physical Fitness Tests in Female Fibromyalgia Patients. International Journal of Sports Medicine.

31. Sandin, B., Chorot, P., Lostao, L., Joiner, T. E., Santed, M. A., & Valiente, R. M. (1999). [The PANAS Scales of Positive and Negative Affect: Factor Analytic Validation and Cross-cultural Convergence]. Psicothema, 11(1), 37-51.

32. Atienza, F. L., Pons, D., Balaguer, I., & García-Merita, M. (2000). [Psychometric properties of the satisfaction with life scale in adolescents]. Psicothema, 12(2), 314-319.

33. Davis, M. C., & Zautra, A. J. (2013). An online mindfulness intervention targeting socioemotional regulation in fibromyalgia: results of a randomized controlled trial. Annals of Behavioral Medicine, 46(3), 273-284.

34. Lumley, M. A., Cohen, J. L., Stout, R. L., Neely, L. C., Sander, L. M., & Burger, A. J. (2008). An Emotional Exposure-Based Treatment of Traumatic Stress for People with Chronic Pain: Preliminary Results for Fibromyalgia Syndrome. Psychotherapy (Chic), 45(2), 165-172.

35. Pernambuco, A. P., Schetino, L. P., Viana, R. S., Carvalho, L. S., & d'Avila Reis, D. (2014). The involvement of melatonin in the clinical status of patients with fibromyalgia syndrome. Clinical and Experimental Rheumatology.

36. van Middendorp, H., Lumley, M. A., Jacobs, J. W., van Doornen, L. J., Bijlsma, J. W., & Geenen, R. (2008). Emotions and emotional approach and avoidance strategies in fibromyalgia. Journal of Psychosomatic Research, 64(2), 159-168.

37. Rivera, J., & Gonzalez, T. (2004). The Fibromyalgia Impact Questionnaire: a validated Spanish version to assess the health status in women with fibromyalgia. Clinical and Experimental Rheumatology, 22(5), 554-560.

38. Zautra, A. J., Johnson, L. M., & Davis, M. C. (2005). Positive affect as a source of resilience for women in chronic pain. Journal of Consulting and Clinical Psychology, 73(2), 212-220.

39. Carville, S. F., Arendt-Nielsen, S., Bliddal, H., Blotman, F., Branco, J. C., Buskila, D., Da Silva, J. A., Danneskiold-Samsoe, B., Dincer, F., Henriksson, C., Henriksson, K. G., Kosek, E., Longley, K., McCarthy, G. M., Perrot, S., Puszczewicz, M., Sarzi-Puttini, P., Silman, A., Spath, M., & Choy, E. H. (2008). EULAR evidence-based recommendations for the management of fibromyalgia syndrome. Annals of the Rheumatic Diseases, 67(4), 536-541.

40. de Souza, J. B., Goffaux, P., Julien, N., Potvin, S., Charest, J., & Marchand, S. (2009). Fibromyalgia subgroups: profiling distinct subgroups using the

Fibromyalgia Impact Questionnaire. A preliminary study. Rheumatology International, 29(5), 509-515.

41. Calandre, E. P., Garcia-Carrillo, J., Garcia-Leiva, J. M., Rico-Villademoros, F., Molina-Barea, R., & Rodriguez-Lopez, C. M. (2011). Subgrouping patients with fibromyalgia according to the results of the Fibromyalgia Impact Questionnaire: a replication study. Rheumatology International, 31(12), 1555-1559.

42. Wilson, H. D., Robinson, J. P., & Turk, D. C. (2009). Toward the identification of symptom patterns in people with fibromyalgia. Arthritis and Rheumatism, 61(4), 527-534.

43. van Koulil, S., Effting, M., Kraaimaat, F. W., van Lankveld, W., van Helmond, T., Cats, H., van Riel, P. L., de Jong, A. J., Haverman, J. F., & Evers, A. W. (2007). Cognitive-behavioural therapies and exercise programmes for patients with fibromyalgia: state of the art and future directions. Annals of the Rheumatic Diseases, 66(5), 571-581.

44. van Koulil, S., van Lankveld, W., Kraaimaat, F. W., van Helmond, T., Vedder, A., van Hoorn, H., Donders, A. R., Wirken, L., Cats, H., van Riel, P. L., & Evers, A. W. (2011). Tailored cognitive-behavioural therapy and exercise training improves the physical fitness of patients with fibromyalgia. Annals of the Rheumatic Diseases, 70(12), 2131-2133.

595 **Table 1.** Characteristics of participants in the study (*n*=424).

Characteristics	**Value**
Age (years)	51.24 (7.40)
Marital status, n (%)	
Married	323 (76.20)
Single	34 (8.00)
Separated/divorced/widow(er)	67 (15.80)
Educational level, n (%)	
Unfinished studies	38 (9.00)
Primary school	207 (48.80)
Professional training	66 (15.60)
Secondary school	55 (13.00)
University degree	58 (13.70)
Working status, n (%)	
Unemployed	309 (72.90)
Part time employed	46 (10.80)
Full time employed	69 (16.30)
Fibromyalgia diagnosis, n (%)	
Years since the first symptoms until diagnosis	
Less than 1 year	39 (9.20)
Between 1 and 5 years	176 (41.50)
More than 5 years	196 (46.20)
Missing data	13 (3.10)
Years since clinical diagnosis	

Less than 1 year	26 (6.10)
Between 1 and less than 5 years	143 (33.70)
More than 5 years	242 (57.10)
Missing data	13 (3.10)
Body Mass Index (BMI) status, n (%)	
Normal-weight (BMI 18.5-24.9 kg/m^2)	123 (29.00)
Overweight (BMI 25.0-29.9 kg/m^2)	155 (36.60)
Obese (BMI e 30.0 kg/m^2)	146 (34.40)
Alcohol consumption frequency, n (%)	
Never	233 (54.95)
Only weekdays or weekends	120 (28.30)
Both weekdays and weekends	68 (16.04)
Missing data	3 (0.71)
Smoking status, n (%)	
Non smoker	299 (70.52)
Smoker, but not everyday	14 (3.30)
Daily smoker	110 (25.94)
Missing data	1 (0.24)
Overall physical fitness [†]	
30-second chair stand test (repetitions)	10.47 (3.19)
Arm curl test (repetitions)	14.35 (4.94)
Handgrip strength test (kg)	19.39 (6.38)
Chair sit an reach test (cm)	-11.00 (11.88)
Back scratch test (cm)	-13.62 (12.09)
8-feet up and go test (s)	6.85 (2.07)

6-minute walk test (m)	487.84 (80.95)	596
		597
Subjective well-being		598
		599
Positive affect (PANAS)	23.01 (6.78)	600
		601
Negative affect (PANAS)	24.01 (8.46)	602
		603
Cognitive well-being (SWLS)	14.04 (4.62)	604
Fibromyalgia severity (FIQ)	65.37 (14.78)	605

606 *Note.* Means (standard deviations) are presented unless otherwise indicated. FIQ =
607 Fibromyalgia impact questionnaire; PANAS = Positive and negative affect schedule;
608 SWLS = Satisfaction with life scale; † Overall physical fitness was calculated as the
609 weighted average of the age-specific z-scores of the four physical fitness components:
610 cardio-respiratory fitness, flexibility, motor agility/dynamic balance, and muscular
611 strength.

612

613

614

615

616

617

618

619

620

621

622

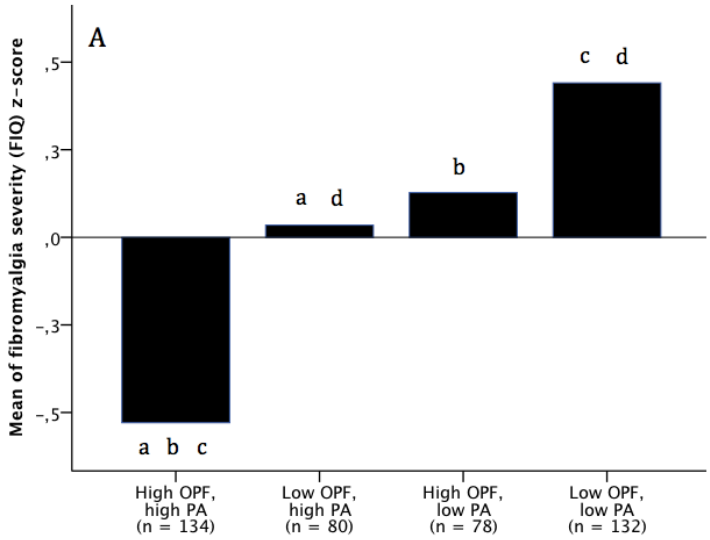
623

Table 2. Sequential linear regression examining the associations of overall physical fitness, positive affect, negative affect, and cognitive well-being with fibromyalgia severity (n=424).

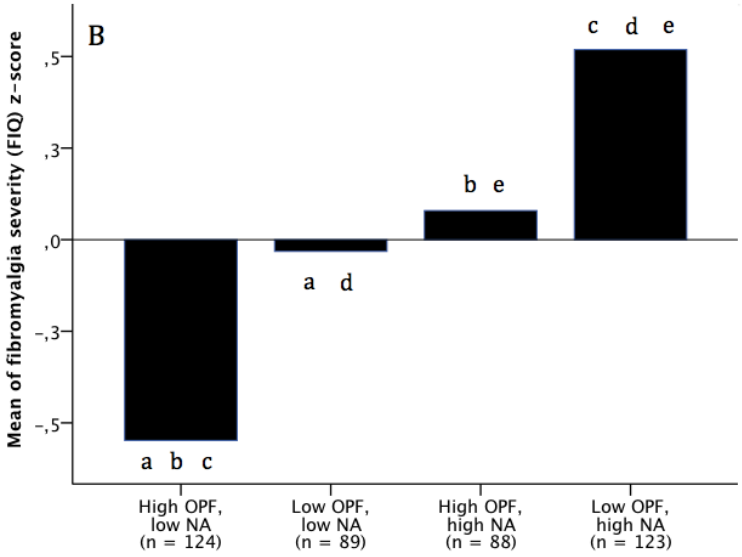
	B (SE)	^{2}	**Adj. R^2**
Step 1			.15***
Overall physical fitness†	-7.65 (0.89)	-.39***	
Step 2			.33***
Overall physical fitness†	-4.81 (0.84)	-.24***	
Positive affect (PANAS)	-0.52 (0.10)	-.24***	
Negative affect (PANAS)	0.54 (0.08)	.31***	
Step 3			.35***
Overall physical fitness†	-4.5 (0.83)	-.23***	
Positive affect (PANAS)	-0.39 (0.10)	-.18***	
Negative affect (PANAS)	0.45 (0.08)	.26***	
Cognitive well-being (SWLS)	-0.57 (0.15)	-.18***	

Note. B and ^{2} = unstandardized and standardized regression coefficients, respectively; *SE* = Standard Error; PANAS = Positive and Negative Affect Schedule; SWLS = Satisfaction With Life Scale; † Overall physical fitness was calculated as the weighted average of the age-specific z-scores of the four physical fitness components: cardio-respiratory fitness, flexibility, motor agility/dynamic balance, and muscular strength.

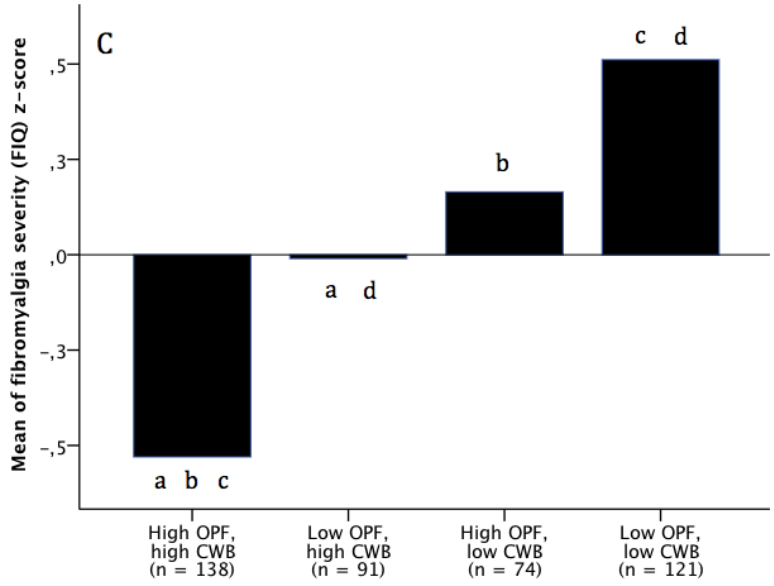
Fibromyalgia severity was assessed by the Fibromyalgia Impact Questionnaire. Adjusted R^2 (Adj. R^2) with significance levels of F-change. * P < .05, ** P < .01, *** P < .001.



637
638



639



640
641

Figure 1. Combined impact of overall physical fitness (OPF) and (A) positive affect (PA); (B) negative affect (NA); and (C) cognitive well-being (CWB) on fibromyalgia severity in women patients (*n*=424) assessed using one-way analysis of variance (ANOVA).

Note. Overall physical fitness was calculated as the weighted average of the age-specific z-scores of the four physical fitness components: cardio-respiratory fitness, flexibility, motor agility/dynamic balance, and muscular strength. PA and NA were assessed using the PANAS. CWB was assessed using the SWLS. Common superscripts indicate significant differences between fibromyalgia severity (assessed using the Fibromyalgia Impact Questionnaire) across groups ($P < .05$, Bonferroni-corrected for multiple comparisons). Mean (Standard Deviation) of OPF, PA, NA, and CWB was 0.57 (0.33), 28.48 (4.78), 30.86 (6.21), and 17.51 (2.86), respectively, for "high" levels group; and -0.57 (0.60), 17.63 (3.16), 17.23 (3.43), and 9.96 (2.42), respectively, for "low" levels group.

Table 3. Mean (standard error) fibromyalgia severity for participants grouped according to their combined overall physical fitness and subjective well-being (positive affect, negative affect, cognitive well-being; *n*=424).

Positive affect (PA)	**High OPF, high PA (*n*=134)**	**Low OPF, high PA (*n*=80)**	**High OPF, low PA (*n*=78)**	**Low OPF, low PA (*n*=132)**	**Difference[†] (%)**	**Effect size[†]**
Fibromyalgia severity (FIQ)	57.54 (1.36)	65.88 (1.60)	67.25 (1.23)	71.88 (1.07)	14.34	1.01 (0.76, 1.27)
Negative affect (NA)	**High OPF, low NA (*n*=124)**	**Low OPF, low NA (*n*=89)**	**High OPF, high NA (*n*=88)**	**Low OPF, high NA (*n*=123)**	**Difference[†] (%)**	**Effect size[†]**
Fibromyalgia severity (FIQ)	57.26 (1.40)	64.89 (1.41)	66.54 (1.27)	73.04 (1.13)	15.78	1.12 (0.85, 1.38)
Cognitive well-being (CWB)	**High OPF, high CWB (*n*=138)**	**Low OPF, high CWB (*n*=91)**	**High OPF, low CWB (*n*=74)**	**Low OPF, low CWB (*n*=121)**	**Difference[†] (%)**	**Effect size[†]**
Fibromyalgia severity (FIQ)	57.53 (1.29)	65.22 (1.42)	67.81 (1.38)	72.93 (1.13)	15.40	1.10 (0.84, 1.37)

678 *Note.* OPF = Overall physical fitness; FIQ = Fibromyalgia Impact Questionnaire. † Difference (%) and effect size statistics - Cohen's *d* (95%

679 exact confidence interval) - were performed between the groups with the lowest and the highest fibromyalgia severity scores.

680
681
682

683